King County
Department of Permitting and Environmental Review
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206-296-6600
TTY Relay: 711

2009 Washington State Energy Code E03 02/20/2013
Ventilation and Air Quality

ENERGY RESIDENTIAL SUBMITTAL FORM: Component Performance

ERSF2009-CompPerf.xls

For alternate formats, call 206-296-6600.

Applicant's name _____ K.C. tracking no. _____

GENERAL INFORMATION

select applicable item from options given Conditioned sq. ft.= _____

Job type: New Building ☐ Addition ☐ Remodel ☐
Occupancy: Single Family ☐ Duplex ☐ Accessory Building ☐
Heating fuel: Gas ☐ Electric ☐ Oil ☐ Propane ☐ Other: _____
Heating system: Forced Air ☐ Room Heaters ☐ Radiant ☐ Hydronic ☐
Heat Pump ☐ Existing System ☐ Other: _____
Location of Heating Equipment _____
Total number of bedrooms in dwelling: _____ Total square footage of dwelling/addition: _____

WHOLE HOUSE VENTILATION SYSTEMS

Check the "whole house ventilation system" that will be used

- ☐ whole house ventilation using exhaust fans (FORM # VIAQ 2): IMC Section 403.8.6
- ☐ whole house ventilation integrated with a forced-air system (FORM # VIAQ 3): IMC Section 403.8.7
- ☐ whole house ventilation using a supply fan (FORM # VIAQ 4) IMC Section 403.8.8
- ☐ whole house ventilation using a heat recovery ventilation system (FORM # VIAQ 5): IMC Section 403.8.9
- ☐ Engineered "whole house ventilation system" designed in compliance with IMC Section 403.8.10

NOTE: In addition to the required "whole house ventilation system," "source specific exhaust ventilation" is required in each kitchen, bathroom, water closet, laundry room, indoor swimming pool, spa, and other rooms where excess water vapor or cooking odors.

LOCATION OF WHOLE HOUSE FAN _____ **SIZE:** _____ **cfm**

EXEMPT FROM WHOLE HOUSE VENTILATION SYSTEMS

- ☐ Building additions with less than 500 square feet of conditioned floor area.
- ☐ Replacement of air-handling/conditioning equipment without altering or repairing the associated air distribution system.

VAPOR RETARDER

Select the type of "vapor retarder" that will be used

Floor:	Wall :	Ceiling:
Slab on grade ☐	4 mil Poly ☐	4 mil Poly ☐
Ext T&G Plywood ☐	Face Stapled Backed Batts ☐	Face Stapled Backed Batts ☐
4 mil Poly ☐	PVA Paint ☐	PVA Paint ☐
		Not Applicable ☐

ENERGY IMPROVEMENT CREDIT OPTION:

(Minimum of one credit point required) (descriptions on pg.9)

- ☐ 1a High Efficiency HVAC 1 (1 pt)
- ☐ 1b High Efficiency HVAC 2 (2 pts)
- ☐ 1c High Efficiency HVAC 3 (1 pt)
- ☐ 2 High Efficiency HVAC Distr. System (1 pt)
- ☐ 3a Efficient Building Envelope 1 (0.5 pt)
- ☐ 3b Efficient Building Envelope 2 (1 pt)
- ☐ 3c Super-efficient Building Envelope 3 (2 pts)
- ☐ 4a Air Leakage Control and Efficeint Ventilation (0.5 pt)
- ☐ 4b Addtn'l Air Leakage Control & Efficient Ventilation (1 pt)
- ☐ 5a Efficienct Water Heating (0.5 pt)
- ☐ 5b High Efficiency Water Heating (1.5 pts)
- ☐ 6 Small Dwelling Unit < 1500 sf or Addtn < 750 sf (1 pt)
- ☐ 7 Large Dwelling Unit > 5,000 sq.ft.(-1 pt)
- ☐ 8 Renewable Electric Energy (0.5 pt)

2009 WSEC Chapter 5 Compliance Form - *Zone 1* ,
Residential Component Performance Calculations - All Heat Sources

WSEC Component Performance BUDGET Calculation:

	Insulation value	U-Value	Area		UA
Attic Area	R-49	0.027		=	
Vaulted Ceiling	R-38	0.027		=	
Glazing Area (15% floor area)		0.300		=	
Skylights		0.500		=	
Door Area		0.200		=	
Above Grade Walls	R-21	0.056		=	
Floor Area	R-30	0.029		=	
Slab on-Grade (length)	R-10	0.540		=	
Below Grade Walls (0-2 ft)	R-21	0.056		=	
Below Grade Walls (2-3.5 ft)	R-21	0.042		=	
Slab 2-3.5 ft (length)	-	0.590		=	
Below Grade Walls (3.5-7 ft)	R-21	0.041		=	
Slab 3.5-7 ft (length)	-	0.640		=	
Below Grade Walls (>7 ft)	R-21	0.037		=	
Slab >7 ft (length)	-	0.570		=	
			Budget Total =		

WSEC Component Performance PROPOSED Calculation:

	Framing type? Adv / Std / Int	Insulation value	average U-Value	Area		UA
Attic Area					=	
Vaulted Ceiling					=	
Glazing Area					=	
Skylights					=	
Door Area					=	
Above Grade Walls					=	
Floor Area					=	
Slab on-Grade (length)					=	
Below Grade Walls (0-2 ft)					=	
Slab 2-3.5 ft length		f value=			=	
Below Grade Walls (2-3.5 ft)					=	
Slab 3.5-7 ft length		f value=			=	
Below Grade Walls (3.5-7 ft)					=	
Slab >7 ft length		f value=			=	
Below Grade Walls (>7 ft)					=	
Mulltiple slab / below grade walls					=	
				Proposed Total =		

Door and Glazing Summary (submit window and door schedule if multiple U-values are used)

	size (WxH)	Area (sq.ft.)	U-Value	UA-value		Quantity	Area (sq.ft.)	U-Value	UA-value
Entry door					Basement windows				
garage door					1st floor windows				
other doors					2nd floor windows				
other doors					3rd floor windows				
TOTALS:					TOTALS:				

2009 WSEC Chapter 5 Compliance Form - *Zone 1* ,
U-Value averaging for multiple assemblies

Component description	Insulation value	U-Value	Area		UA
Attic					
				=	
				=	
				=	
				=	
				=	
U-average=				=	
Component description	Insulation value	U-Value	Area		UA
Vaulted ceiling					
				=	
				=	
				=	
				=	
				=	
U-average=				=	
Component description	Insulation value	U-Value	Area		UA
Floors over unheated areas					
				=	
				=	
				=	
				=	
				=	
U-average=				=	
Component description	Insulation value	U-Value	Area		UA
Walls					
				=	
				=	
				=	
				=	
				=	
U-average=				=	
Component description	Insulation value	U-Value	Area		UA
Slab on-grade / Below grade walls					
				=	
				=	
				=	
				=	
				=	
U-average=				=	

2009 Residential WSEC Chapters 5 and 6 Heating System Sizing

The 2009 Washington State Energy Code (WSEC) requires that heating and cooling systems for residential projects to be sized. With few exceptions heating and cooling systems may not exceed 150% of the design loads as calculated per the 2009 WSEC.

This form will only size an electric, natural gas, LPG or oil fired heating system when all the required information has been filled out. The type of insulation and areas involved, skylights, doors, and window sections of this form must be completed accurately.

If your system provides cooling it must be sized using ASHRAE Manual J or equivalent calculations and they must be attached to this form. Please contact your mechanical contractor for this information.

Please read and check the appropriate box below	
☐ **A**	I am using this form to define the project, propose a whole house ventilation method, vapor retarders, component performance path for R-Values for insulation and U-values for doors and windows, and to size the heating system.
☐ **B**	I am using this form to define my project and propose the whole house ventilation, vapor retarders, component performance path for the R-Values of insulation and U-values for doors and windows, and to size the heating system. The heating system installed will be fueled by natural gas, propane, or oil with an annual fuel utilization efficiency (AFUE) of 92% or greater.
☐ **C**	This project is using a Manual J or an approved equivalent method for sizing the heating system. I have attached the form that sizes my equipment .
☐ **D**	This project is using a heating and cooling system. A Manual J or an approved equivalent method for sizing the heating and cooling system is attached. I have attached the form that sizes my equipment .
☐ **E**	This project is using a heating system fueled by natural gas or oil, is less than 1500 sq.ft. in size, and is in compliance with Prescriptive Path Option IV. A heating system not to exceed 40,000 Btu/H total output will be installed. The following Heating System sizing calculations are not required to be completed.

Simple Heating System Size: Climate Zone 1

Indoor Design Temperature: 70

Temperature Range: ____ ____ City: ____

Design Temperature Difference = ____ (Use 48 as default if outdoor design temperature is not known)

(Indoor - Outdoor Design Temp) (recommended outdoor design temperatures shown on page 5)

Conditioned Floor Area = ____

Conditioned Volume (CV) = ____

Sum of UA (proposal total from page 2) ____

	other fuels		electric	
Envelope Heat Load	____	Btu / Hour	____	KW
Sum of UA X Design Temperature Difference	***Convert Btu / hr to electric KW: Btu ÷ 3413***			
Air Leakage Heat Load	____	Btu / Hour	____	KW
CV X 0.6 X Design Temperature Difference X .018				
Building Design Heat Load	____	Btu / Hour	____	KW
Air Leakage + Envelope Heat Load				
Minimum Heating Equipment Output	____	Btu / Hour	____	KW
Building Design Heat Load x 1.15 or 1	____			

Use 1.15 if ducts are located in unconditioned space: Sum of Building Heat Loss X 1.15

Use 1 if ducts are located in conditioned space: Sum of Building Heat Loss X 1

Maximum Heating Equipment Output	____	Btu / Hour	____	KW
Minimum Heating Equipment Output X 1.50				

2009 WSEC Chapter 5 Compliance Form - *Zone 1*

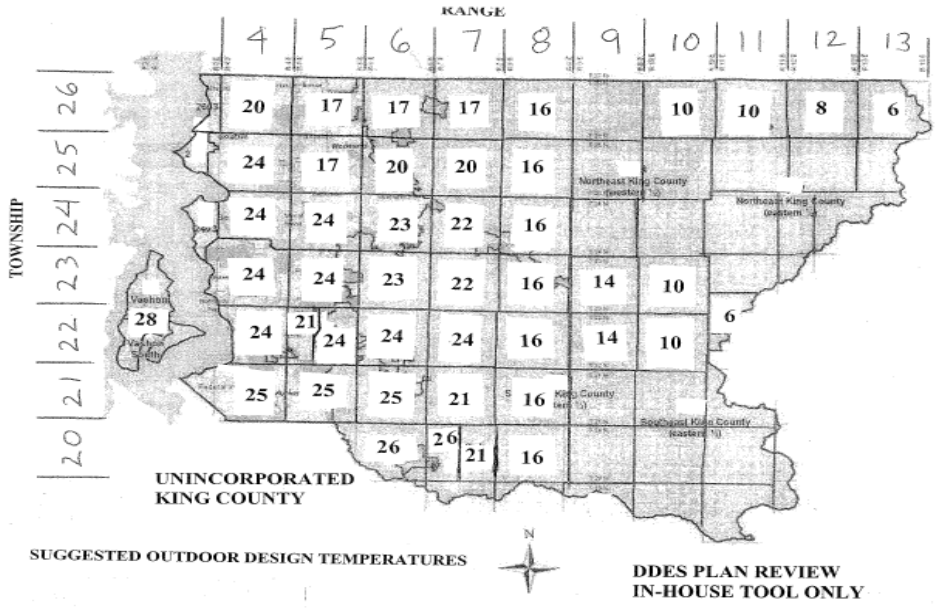
Upgrades to Existing Building to Offset Non-Compliance of Addition less than 750 sq. ft

WSEC BUDGET [ ] **minus Proposal UA Total** [ ] **= UA Compliance Deficit** [ ]

Proposed upgrades to existing building elements:

			existing		new		
type	Brief description of change	Sq. Ft.	R-Value	Value	R-value	U-value	UA deficit
				Summation of upgrades:			

Recommended outdoor design temperatures for heat sizing calculation



VENTILATION AND INDOOR AIR QUALITY CODE

2009 International Mechanical Code Table 403.8.1 (continuously operating systems)

MINIMUM VENTILATION RATES FOR DWELLINGS FOUR STORIES OR LESS

	Number of Bedrooms								
Floor Area (sq.ft.)	0	1	2	3	4	5	6	7	>7
0 1500	30	30	45	45	60	60	75	75	90
1501 to 3000	45	45	60	60	75	75	90	90	105
3001 to 4500	60	60	75	75	90	90	105	105	120
4501 to 6000	75	75	90	90	105	105	120	120	135
6001 to 7500	90	90	105	105	120	120	135	135	150
> 7501	105	105	120	120	135	135	150	150	165

2009 International Mechanical Code Table 403.8.5.1

VENTILATION EFFECTIVENESS FOR INTERMITTENT FANS

Check operating time	DAILY FRACTIONAL OPERATION TIME, f	VENTILATION EFFECTIVENESS, E_f	Min. Size
	< 35 %, operating less than 8 hrs.	0.33	
	35% < f < 60%, operating between 8 and 14 hrs.	0.5	
	60% < f < 80%, operating between 14 and 19 hrs.	0.75	
	80% < f , operating more than 20 hrs.	1.0	

WSEC Chapter 10 U-Values

CEILINGS		Framing	
TYPE	Insulation	Standard	Advanced
Flat	R-19	0.049	0.047
	R-30	0.036	0.032
	R-38	0.031	0.026
	R-49	0.027	0.020
	R-60	0.025	0.017
Scissor truss			
R-30	4:12 roof pitch	0.043	0.031
R-38	4:12 roof pitch	0.040	0.025
R-49	4:12 roof pitch	0.030	0.020
R-30	5:12 roof pitch	0.039	0.032
R-38	5:12 roof pitch	0.035	0.026
R-49	5:12 roof pitch	0.032	0.020
Vaulted		16" OC	24" OC
R-19	vented 2x10	0.049	0.048
R-30	vented 2x12	0.034	0.033
R-38	vented 2x14	0.027	0.027
R-30	unvented 2x10	0.034	0.033
R-38	unvented 2x12	0.029	0.027

WALLS		FRAMING		
	Insulation	Standard	Intermed.	Advanced
	Lapped Wood Siding			
2X4	R-11	0.088		0.084
	R-13	0.082		0.078
	R-15	0.076		0.071
2X6	R-19	0.062	0.058	0.055
	R-21	0.057	0.054	0.051
	R-22	0.059	0.055	0.052
	(2) R-11	0.060	0.057	0.054
2X8	R-25	0.051	0.047	0.045
	T1-11 Siding			
2X4	R-11	0.094		0.09
	R-13	0.088		0.083
	R-15	0.081		0.075
2X6	R-19	0.065	0.061	0.058
	R-21	0.06	0.056	0.053
	R-22	0.062	0.058	0.054
	(2) R-11	0.063	0.059	0.056
2X8	R-25	0.053	0.049	0.046

METAL STUDS		16" OC	24" OC
4-inch	R-11	0.132	0.116
4-inch	R-13	0.124	0.108
4-inch	R-15	0.118	0.102
6-inch	R-19	0.109	0.094
6-inch	R-21	0.106	0.090
8-inch	R-25	0.08	0.091

LOG WALLS			R-1.25/ inch
	(average	6"	0.148
	log	8"	0.111
	diameter)	10"	0.089
		12"	0.074
		14"	0.063

FLOORS		
Insulation	Post & Beam	Joists
R-0	0.112	0.134
R-11	0.052	0.056
R-19	0.038	0.041
R-22	0.034	0.037
R-25	0.032	0.034
R-30	0.028	0.029
R-38	0.024	0.025

SLAB on GRADE	
UNHEATED	
R-0 uninsulated	0.73
R-5 2ft hor. No t.b.	0.70
R-10 2ft hor. No t.b.	0.70
R-15 2ft hor. No t.b.	0.69
R-5 4ft hor. No t.b.	0.67
R-10 4ft hor. No t.b.	0.64
R-15 4ft hor. No t.b.	0.63
R-5 2ft vert	0.58
R-10 2ft vert	0.54
R-15 2ft vert	0.52
R-5 4ft vert	0.54
R-10 4ft vert	0.48
R-15 4ft vert	0.45
R-10 fully insulated	0.36
HTD R0 uninsulated	0.84
HTD R5 fully insulated	0.74
HTD R10 fully insulate	0.55
HTD R15 fully insulate	0.44

BELOW GRADE WALLS			Slab
	depth	U-value	F-factor
2 ft below grade	uninsulated	0.350	0.59
	R-11 interior	0.066	0.68
	R-11 w/tb	0.070	0.60
	R-19 interior	0.043	0.69
	R-19 w/tb	0.045	0.61
	R-10 exterior	0.070	0.60
	R-12 exterior	0.061	0.60
3.5 ft below grade	uninsulated	0.278	0.53
	R-11 interior	0.062	0.63
	R-11 w/tb	0.064	0.57
	R-19 interior	0.041	0.64
	R-19 w/tb	0.042	0.57
	R-10 exterior	0.064	0.57
	R-12 exterior	0.057	0.57
7 ft below grade	uninsulated	0.193	0.46
	R-11 interior	0.054	0.56
	R-11 w/tb	0.056	0.42
	R-19 interior	0.037	0.57
	R-19 w/tb	0.038	0.43
	R-10 exterior	0.056	0.42
	R-12 exterior	0.050	0.42

WSEC TABLE 9-1: ENERGY CREDIT OPTION DESCRIPTIONS

1a	**High Efficiency HVAC Equipment 1:** gas, propane, or oil-fired furnace or boiler with minimum AFUE of 92% or Air-source heat pump with minimum HSPF of 8.5	
1b	**High Efficiency HVAC Equipment 2:** closed loop ground source heeat pump with minimum COP of 3.3	
1c	**High Efficiency HVAC Equipment 3:** where primary space heating system is zonal electric heating, a ductless heat pump system shall be installed to provide heating to at least one zone.	
2	**High Efficiency HVAC Distribution:** All heating and cooling components installed inside conditioned space. All combustion equipment shall be direct vent or sealed combustion. No system components to be installed in crawlspace. No electric resistance heat permitted. Direct combustion heating equipment with AFUE of >80%. Up to 5% of ducts total linear footage may be located in exterior cavities of buffer spaces if tested leakage to the oudoors is less than or equal to 1 cfm per 100 sq.ft. of conditioned floor area when tested at a pressure differential 25 PA across the entire system, including the air handler enclosure.	
3a	**Efficient Building Envelope 1:** Table 6-1 Prescriptive Option III compliance with window U = 0.28, floor R-38, slabs R-10 full, or Component Performance compliance with Target UA from Table 5-1 reduced by 5%.	
3b	**Efficient Building Envelope 2:** Table 6-1 Prescriptive Option III compliance with window U = 0.25, wall R-21 plus R-4, floor R-38, all slabs R-10 full with below grade walls R-21 plus R-5, or Component Performance compliance with Target UA from Table 5-1 reduced by 15%.	
3c	**Efficient Building Envelope 3:** Table 6-1 Prescriptive Option III compliance with window U = 0.22, wall R-21 plus R-12, floor R-38, slabs R-10 full with below grade walls R-21 plus R12, and R-49 advanced frame ceilings and vaulted areas, or Component Performance compliance with Target UA from Table 5-1 reduced by 30%.	
4a	**Air leakage Control and Efficient Ventilation:** Envelope leakage reduced to SLA of 0.00020 building envelope tightness when tested with blower door at pressure difference of 50 PA after rough in and installation of all building envelope penetrations; and all whole house ventilation requirements met by heat recovery ventilation system per WSEC section 1508.7.	
4b	**Air leakage Control and Efficient Ventilation:** Envelope leakage reduced to SLA of 0.00015 building envelope tightness when tested with blower door at pressure difference of 50 PA after rough in and installation of all building envelope penetrations; and all whole house ventilation requirements met by heat recovery ventilation system per WSEC section 1508.7.	
5a	**Efficient Water Heating:** Water heating system shall include one of the following: gas, propane or oil water heater with minimum EF of 0.62 or electric water heater with minimum EF of 0.93 **AND** for both cases all showerheads and kitchen sink faucets shall be rated at 1.75 gpm or less, all others at 1.0 gpm or less when tested in accordance with ASME A112.18.1/CSA B125.1.	
5b	**Efficient Water Heating:** Water heating system shall include one of the following: gas, propane or oil water heater with minimum EF of 0.82; **OR** solar water heating supplementing minimum standard water heater. Solar water heating will provide rated minimum savings of 85 therms or 2000 kWh bsed on Solar rating and Certification Corp (SRCC) Annual Performance of OG-300 Sertified Solar Water Heating Systems; **OR** Electric heat pump water heater with minimum EF of 2.0.	
6	**Small Dwelling Unit:** Dwelling less than 1500 sq.ft. with less than 300 sq.ft. window and door openings. Additions to existing building that are less than 750 sq.ft. of heated floor area.	
7	**Large Dwelling Unit:** Dwelling exceeding 5000 sq.ft. floor area shall be assessed a deduction.	
8	**Renewable Electric Energy:** for each 1200 kWh of electricla generation provided annually by on-site wind or solar equipment a 0.5 credit shall be allowed, up to 3 credits. Generation shall be calculated as follows:	
	=	**Solar electric systems**: design shall be demonstrated to meet requirement using the National Renewable Energy laboratory calculator PVWATTs. Solar access documentation to be included.
	=	**Wind generation projects**: design shall document annual power generation based on the following factors: wind turbine power curve, average annual wind speed at the site, frequency distribution of the wind speed at the site and the height of the tower.

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Duct Leakage Affidavit

Permit #: _____

House address or lot number: _____

City: _____ Zip: _____

Cond. Floor Area (ft^2): _____ Source (circle one): Plans Estimated Measured

☐ Duct tightness testing is not required for this residence per exceptions listed at the end of this document

Air Handler in conditioned space? ☐ yes ☐ no Air Handler present during test? ☐ yes ☐ no

Circle Test Method: Leakage to Outside Total Leakage

Maximum duct leakage:

Total duct leakage air handler installed: (floor area x .08) = _____CFM@25 Pa

Total duct leakage air handler not installed: (floor area x .04) = _____CFM@25 Pa

Leakage to outdoors: (floor area x .06) = _____CFM@25 Pa

Test Result: _____CFM@25Pa

Ring (circle one): Open 1 2 3

Duct Blaster Location: _____ Pressure Tap Location: _____

I certify that these duct leakage rates are accurate and determined using standard duct testing protocol.

Company Name: _____Technician: _____

Date: _____ Phone Number: _____

Washington State Energy Code reference:

503.10.2 Sealing. All ducts, air handlers, filter boxes, and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.3 of the *International Residential Code* or 603.9 of the *International Mechanical Code*. Duct tightness testing shall be conducted to verify that the ducts are sealed. A signed affidavit documenting the test results shall be provided to the jurisdiction having authority by the testing agent. When required by the building official, the test shall be conducted in the presence of department staff.

Exceptions: 1. Duct tightness test is not required if the air handler and all ducts are located within conditioned space.

2. Duct testing is not required if the furnace is a nondirect vent type combustion appliance installed in an unconditioned space. A maximum of six feet of connected ductwork in the unconditioned space is allowed. All additional supply and return ducts shall be within the conditioned space. Ducts outside the conditioned space shall be sealed with a mastic type duct sealant and insulated on the exterior with R-8 insulation for above grade ducts and R-5 water resistant insulation when within a slab or earth.

Energy Code Support

WASHINGTON STATE UNIVERSITY EXTENSION ENERGY PROGRAM

Duct Leakage Affidavit (Existing Construction)

Permit #: _____

House address or lot number: _____

City: _____ Zip: _____

Cond. Floor Area (ft^2): _____ Source (circle one): Plans Estimated Measured

☐ Duct tightness testing is not required for this residence per exceptions listed at the end of this document

Air Handler in conditioned space? ☐ yes ☐ no Air Handler present during test? ☐ yes ☐ no

Maximum duct leakage (check method used):

☐ **Method 1**

Total duct leakage, air handler installed: (floor area x .08) = _____CFM@25 Pa

☐ **Method 2**

Leakage to outdoors: (floor area x .06) = _____CFM@25 Pa

Test Result: _____CFM@25Pa

Ring (circle one): Open 1 2 3

Duct Blaster Location: _____ Pressure Tap Location: _____

☐ **Method 3**

The measured duct leakage shall be reduced by more than 50% relative to the measured leakage prior to the installation or replacement of the space conditioning equipment. A visual inspection including a smoke test shall demonstrate that all accessible leaks have been sealed.

Pre-installation test result: _____CFM@25Pa

Post installation test result: _____CFM@25Pa

Post installation leakage rate must be less than 50% of pre-installation rate

Company Name: _____ Duct Testing Technician: _____

Date: _____ Phone Number: _____

☐ **Method 4**

If it is not possible to meet the duct requirements of 1, 2 or 3, all accessible leaks shall be sealed and verified through a visual inspection and a smoke test by a certified third party.

I certify that these duct leakage rates are accurate and determined using standard duct testing protocol and all accessible leaks have been sealed.

Company Name:_____ Certified Third Party:_____ Date:_____

Washington State Energy Code reference:

101.3.2.6 Mechanical Systems: Those parts of systems which are altered or replaced shall comply with Section 503 of this Code when a space-conditioning system is altered by the installation or replacement of space-conditioning equipment (including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, cooling or heating coil, or the furnace heat exchanger), the duct system that is connected to the new or replacement space-conditioning equipment shall be sealed, as confirmed through field verification and diagnostic testing in accordance with procedures for duct sealing of existing duct systems as specified in the RS-33, to one of the following requirements.

Exceptions: 1. Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in RS-33.

2. Ducts with less than 40 linear feet in unconditioned spaces.

3. Existing duct systems constructed, insulated or sealed with asbestos.